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Henry Harding

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A

PRACTICAL TREATISE

ON THE

CONSTRUCTION OF CHIMNEYS,

CONTAINING

AN EXAMINATION OF THE COMMON MODE IN
WHICH THEY ARE BUILT;

WITH AN ACCURATE DESCRIPTION OF

THE NEWLY-INVENTED TUNNEL;

DEMONSTRATING

ITS UTILITY AND SAFETY; ITS IMPORTANCE IN SUPERSEDING THE PAINFUL PRACTICE
OF EMPLOYING CLIMBING-BOYS; THE REMEDY WHICH IT AFFORDS FOR THE
NUISANCE OF SMOKY FLUES; AND THE ADVANTAGES TO BE DERIVED FROM ITS RENDERING THOSE LOFTY SHAFTS, WITH
THEIR NUMEROUS UNSIGHTLY CONTRIVANCES
AT PRESENT IN USE, ENTIRELY
UNNECESSARY;

TOGETHER WITH COMPLETE INSTRUCTIONS FOR ITS ADOPTION,

WHEREBY A COMPETENT JUDGMENT MAY BE FORMED OF THE CAUSES WHICH PREVENT THE
FREE ASCENT OF SMOKE IN CHIMNEYS, AND WORKMEN MAY BE ENABLED
TO APPLY A CURE FOR SO SERIOUS AN EVIL.

ALSO TABLES AND CALCULATIONS, BY WHICH ESTIMATES OF THE
EXPENSE CAN BE FRAMED.

By JOHN WILLIAM HIORT, Architect,
THE INVENTOR AND PATENTEE;
*Chief Examiner in His Majesty's Office of Works and Public
Buildings, Whitehall.*

ILLUSTRATED WITH PLATES.

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PREFACE.

In presenting the following Treatise to public attention, the author is aware that by some persons it may be deemed an act of great presumption; he therefore considers it his duty not only to offer an apology for so doing, but to state the reasons which have induced him to adopt this course.

When the patent had been obtained, and the Patentee was endeavouring to bring it into general notice, he found it indispensable that the operative bricklayer should comprehend its intention and general principle, as well as its practical utility. With a view to effect this object, a few foremen to builders, and bricklayers, were assembled together; and with the aid of drawings and models, he exemplified the improvement in the architectural construction of chimneys, and the mode of building them. This course of proceeding soon obtained publicity; the subject excited a considerable degree of curiosity; and applications to be present at these explanatory exhibitions, or rather what the public has been pleased to designate lectures, were received from all quarters: and although the subject may appear to many persons of a trivial character, yet, at this time, it assumed a consequence which the Patentee never anticipated; for individuals unconnected with, as well as those deeply engaged in, architectural pursuits, have been greatly interested in the success of this invention. Amongst the former may be enumerated, gentlemen connected with the proposed revision of the Building Act; the directors of the several Fire Offices; the Society for superseding the Necessity of Climbing Boys; gentlemen of high literary talents; members of the Society of Arts and Sciences; and others who have no doubt been annoyed by the inconvenience of a smoky fire-side: all of whom have expressed themselves highly in its favour, and are satisfied that this invention has a tendency to forward the several objects which they respectively have in view.

The Patentee was fully aware of the difficulties he had to encounter in endeavouring to overcome deeply-rooted prejudices, as well as by introducing as a universal theorem, a principle differing in all its parts from the practice of several centuries: he was, nevertheless, resolved to attempt the invention of a chimney divested of all the evils incidental to the old mode of construction. To effect this object, the first step necessary was to trace out the sources from which the defects originated; and without arrogating to himself a knowledge superior to other architects, (being convinced that every professional man is equally conversant with this subject,) he has, by way of groundwork for the various operations detailed in this publication, offered to the perusal of the public, an enumeration of the points which appeared, upon actual experiment, from personal observation, and from the experience derived from thirty-six years' practice in His Majesty's Office of Works, to produce the impediments to the free ascent of smoke in chimneys.

The Patentee has not only the satisfaction of knowing that his invention has received the unqualified and unbiassed approbation of the most eminent scientific men, but also of those conversant with the practical part of the building profession; men who are competent to enter into and investigate its minutiæ, and of deciding upon its merits, as well on behalf of the public as for themselves. All concur that the principle is self-evident and unique; but a still greater gratification has resulted to the Patentee, in consequence of their unqualified and favourable decision, by its introduction in its incipient state into the Royal Palaces now erecting in St. James's Park, and several public buildings. Thus encouraged, and under a full conviction of the propriety of giving publicity to the invention, the Patentee has ventured to communicate its principles and advantages to the world in the shape of a treatise, relying on an impartial and unprejudiced consideration of the facts which it contains; the more particularly as the entire details of the invention have been digested and arranged at periods totally unconnected with the performance of the important functions of his official situation. It is very remarkable that notwithstanding the number of years which have elapsed since flues were first constructed, it does not appear that any individual has succeeded in producing either a material or a method by which a substantial improvement in the architectural construction of chimneys could be offered to the favourable notice of the public, although patents without number have been granted for the partial remedy of the various evils.

This subject will consist of three divisions, viz.:

First,—A description of the present mode of constructing chimneys, and the defects incidental thereto.

Second,—A description of the newly-invented flue or tunnel.

Third,—A series of definitions and instructions to workmen, not only to build the new chimney, but to apply the principle to chimneys already constructed.

To the builder and operative bricklayer, the Patentee hopes this work will be acceptable, and useful as a complete *vade mecum* to the subject upon which it treats: and, perhaps, it may tend to stimulate the young aspiring artist to attempt an achievement of some amendment; the Patentee not having the vanity to suppose that his system is unsusceptible of a yet greater improvement, but that like the rough diamond it is ready to receive its polish from the hands of the more skilful master, and thereby add to its intrinsic worth.

The Attention of the Public is particularly directed to the Supplement which accompanies this Treatise.

A PRACTICAL TREATISE

ON THE

CONSTRUCTION OF CHIMNEYS.

PART THE FIRST.

A Description of the present Mode of constructing Chimneys, and the Defects incidental thereto.

ACCORDING to the prevailing mode of construction, the throat of the chimney near the mantle, and immediately over the fire (commonly called the gathering wing), is so large as to contain more air than can be heated by the fuel ordinarily consumed. The vent or flue being formed with angles, and as the smoke ascends in a circular spiral column, those angles serve as conductors for the colder air, which, naturally descending, supplies the throat of the chimney more quickly than the fire can consume or rarefy, and therefore by means of the angles of the fire-place connects with the cold air nearest the floor, causing one continued stream from the top to the bottom, on the principle of a syphon, and attracts with it

Gathering wing.

Vent or flue.

into the room a portion of the smoke *. The plan of the common vent or flue is generally a parallelogram of fourteen inches by nine. (See plate 3, fig. 8.) This form is intended for the purpose of admitting a boy to cleanse it, but the smoke way would be equally good in a flue nine inches by nine.

Thus, as the form of the chimney is calculated to encourage and retain, so likewise the materials and workmanship serve to generate or admit the colder air, the outside rim and divisions between the flues (commonly called wyths) not being of sufficient substance to prevent the air within the chimney becoming condensed by the effects of the atmosphere, or by the cold current in an adjoining chimney where there may not be a fire: these rims and divisions are generally built of brick four inches and a half in thickness. The porous nature of a brick is well known, and the effect on the air within the chimney produced by brick-work when saturated with water, may be

Divisions or wyths.

Air in adjoining chimney.

Porous quality of bricks.

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* The only temporary remedy for this inconvenience is opening a door or a window in the apartment, which creates a stronger opposing current of air.

easily conceived by an experiment performed upon a common porous wine cooler.

Pargetting.

The only means at present used to counteract this effect, is pargetting or plastering the inside of the flue: this when perfectly dry may for a time answer the purpose, but the soot soon adheres thereto, and this evil is increased in proportion to the injury occasioned by frequent scraping, as well as by the rapid decay of the pargetting, which is itself of a perishable nature. The pargetting being removed by these causes, the mortar in the joints of the brick-work becomes decomposed by the action of the cold air on the outside, and the heat within the shaft; hence the necessity for frequent pointing on the outside of the chimney.

Frequent pointing of shafts.

Turn-caps, wind-guards, &c.

It is a mistaken idea that the application of turn-caps, wind-guards, *&c.*, will in every instance correct the defects of a flue, for it is not the mouth of a chimney alone that is always affected by the winds blowing from particular points of the compass, the whole surface of the stack being acted upon in the same manner, when the mortar and the pargetting are in a decomposed and decayed state; and it may be remarked in all cases where there are several flues in one stack, that the flue at the extreme end of the shaft having three sides of it exposed to the weather, becomes soonest affected by the action of the wind and rain. (See *a a*, fig. 2, plate 2.)

Several flues in one stack.

There is not any part of a building which is of necessity so frequently left to the judgment of the operative workman, as the various turns in flues; these turns, as at present constructed, form angles in which the soot accumulates and thereby produces obstructions to the easy passage of the smoke, the size of the flue being also liable to be contracted in these turns as well as other parts of the chimney, which, as a passage for the smoke, is greatly injured by all inequality of size and surface.

Turns and angles in flues.

Flues injured

The brick-work, as before described, of which the flues are constructed, being in one thickness (*viz.*, four and a half inches), see fig. 8, plate 3, is liable to injury by plugs which are frequently driven into the mortar joints for the purpose of fixing joiner's work, and accidents by fire have often occurred from this practice; plumbers are also in the habit of tacking rain-

Driving plugs

Tacking rain-water pipes, &c.

water pipes by driving spikes or wall-hooks through the mortar joints into the flue; and similar mischief occurs by bricklayers cutting putlog holes for scaffolding.

Cutting putlog holes.

Many accidents arise from the unnecessary heightening of a stack of chimneys in one continued line of shaft, as in plate 2, fig. 2. This practice not only exposes them to serious danger during high winds, but occasions an obstruction to the course of the wind, which rushing with increased velocity over the summit of the shaft in a horizontal direction, prevents the lighter air or smoke from rising or emerging out of the flues, and a portion of the current is frequently driven down the chimney.

Wide and lofty shafts.

It cannot therefore be supposed that the air within a chimney-shaft built of such porous material, and so exposed to the weather, will be sufficiently rarefied to resist the action of any partial current operating on the mouth of it.

The funnels or pots, in general use, for the purpose of raising the top of a chimney beyond the influence of the current, are externally of a circular form. (See fig. 2, plate 2.) This form is altogether erroneous, for the divided current of

Circular pots &c.

air closes immediately round the funnels or pots, and, consequently, the outlet for the smoke continues enveloped in the eddy. Chimneys built in the manner before described are cleaned and repaired with much difficulty, danger, and expense; and in some instances to repair them is totally impracticable. The only expedient in such case is to take down and rebuild them.

Danger and difficulty of cleansing and repairing.

Circular flues on old system too expensive.

Circular flues have been preferred by many architects, and have often been adopted, but the trouble and expense of constructing them, have prohibited their general use. It does not therefore appear that hitherto any systematic plan has been brought into practice to remove effectually all the evils before enumerated, or any form of material invented for improving the present mode of constructing chimneys, by which the labours of the workmen in building them could be simplified, and the expense kept within reasonable bounds.

Having thus detailed the defects attendant on the existing practice, the means to be adopted for correcting them will be found stated in the following division.

PART THE SECOND.

A Description of the newly invented Flue or Tunnel.

Circular flue or tunnel.

Warm-air chambers.

Facility of construction.

WITHIN the usual thickness of walls, and incorporated with the common brick-work, circular smoke-flues or tunnels are built of any given diameter. (See plate 1.) Each flue or tunnel is surrounded in every direction from bottom to top by cavities or warm-air chambers (see figs. 3 and 5, plate 3), commencing at the back of every fire-place, and connected with each other, as at *d d d d*, figs. 9, 10, A and B, plate 3. The air confined within these chambers is, by the heat of any one fire, rendered sufficiently warm to prevent condensation within all the flues contained in the same stack of chimneys. These flues or tunnels are erected without difficulty, may be carried to any extent, either perpendicularly or horizontally, and can be adapted with equal ease to every possible bend, turn, or direction, without the smallest deviation from their original form or capacity, or producing internal angles of any description.

Semicircular back of fire-place.

Angles in fire-place avoided.

Air passing through the fire.

Fire-places formed under windows.

The circular flue commences at the throat of the chimney, below the usual line of the chimney-bar,* and immediately over the fire (as at *a*, fig. 4, plate 4, and at *h*, fig. 5, plate 4), and the half circle continues thence down to the hearth, forming the centre of the back of the fire-place. (See *b b*, fig. 4, plate 4.) The usual filling in brick-work in setting stoves, by this means becomes unnecessary, and the angles within the fire-place may be altogether avoided,* as at *a a*, fig. 10, plate 4. Thus the throat of the chimney is made to contain no more air than can be heated by the fuel ordinarily consumed, nor can the air of the room or chamber connect with that of the chimney without passing through or coming in contact with the fire; and should the upper part of the flue admit of a counter current of descending colder air, it must, at a certain point, become rarefied, and return with the centre spiral column of ascending smoke and heated air. The flues in question are particularly applicable in instances where the fire-places are necessarily formed under windows (as shewn by fig. 3, plate 1.)

In building these flues or tunnels, no other

* vide Supplement.—

material is used than the patentee's newly-invented bricks, and the cement by which they are united. These bricks require no labour in cutting, being made on systematic principles, and when applied to the purposes intended, the joints, both horizontally and vertically, are as those of an arch, and therefore capable of resisting great external pressure; and the rim of the flue being in two thicknesses (as at *a a a a*, fig. 5, plate 3), the interior is essentially protected from any injury to which the outside facing of the wall may be liable by plugs driven into the mortar joints by carpenters, *&c*; the course of each flue being also denoted by a stamp or mark on the front of every brick.

Patent bricks require no cutting.

Joints as of an arch.

Rim of flue in two thicknesses.

Course of flues denoted by stamp on the face of the bricks.

From the construction of these chimneys or flues, and the nature of the materials of which they consist, no danger need be apprehended should the soot ignite, (an accident not very likely to happen,) for such an accumulation of soot as common chimneys are liable to, cannot take place within these tunnels, there being no angles in which the soot can lodge, the draught of air through them being much stronger, and the necessity for cleansing them rendered less

Soot not liable to ignite.

Necessity for cleansing less frequent.

Inside of bricks vitrified.

frequent, by vitrifying the insides of the bricks, to prevent adhesion; nevertheless the operation of cleansing may with facility be performed when needful, without the aid of climbing boys, all sharp angular turns, and other impediments, which have hitherto prevented the use of machinery, being totally avoided.

Aid of climbing boys unnecessary.

Flues need not be carried up beyond a certain height.

These flues or chimneys do not require to be carried up to a great height above the roof or parapet in connected masses of brick-work, forming a shaft, as at present practised. (See fig. 2, plate 2.)

Flues in some instances may be concealed.

The tops or terminations of the newly-invented chimneys may, in some situations, be entirely concealed, that is to say, when the chimneys rise in the valley of a double roof, it is not requisite to carry the shaft so high as the ridge (see fig. 3, plate 2); and if they are not concealed, by their formation (not being required to be lofty) they are perfectly secure in the most tempestuous weather. Each flue terminates with a small brick or stone shaft, with stone cap and base (see fig. 1 A, plate 4), so contrived as to preserve to their summit a continuation of the hot air cavities. (See figs. 1 B,

Chimneys secure in tempestuous weather.

Termination of chimneys.

Shafts not encumbered with pots, vanes, cowls, &c.

and 2 A B, plate 4.) These shafts have neither chimney-pot, cowl, vane, nor any other unsightly and expensive contrivance attached thereto, being built so as to present, horizontally and vertically, angles serving to divide or counteract the force of strong gales and sudden gusts of wind, or eddies proceeding from currents of air obstructed by hills, high trees, or buildings.

Gales and eddies of wind, force of counteracted.

It may not be deemed irrelevant here to remark, that air and water are acted upon in the same manner when any object is opposed to the current of either; hence it must have been noticed, that a current of water obstructed by a perpendicular, flat surface, would occasion a sudden swell, and, consequently, flow over the top with increased rapidity; and upon the same principle, when a current of wind drives against the front of a building, it will rush horizontally over the summit, in a ratio apportioned to the degree of obstruction.

Obstructions to the current of air and water produce similar effects.

The ancients, no doubt, soon discovered that this sudden rush of wind prevented the smoke rising and emerging out of the flues, built in the thickness of their walls; in order, therefore, to carry the mouth of their flues above the influence of

Ancient chimney.

Shaft to each flue.

the current, they erected a shaft to each chimney, leaving spaces between them for the free passage of the air (as fig. 1, plate 2). The economy of more modern times has induced builders, instead of carrying up separate shafts, to blend the flues of all the chimneys in one continued line or mass of brickwork (as shewn by fig. 2, plate 2), without considering that by so doing they created an obstruction to the course of the wind, similar to that already described; and in consequence, the outlet for the smoke became obstructed by the air rushing horizontally over the chimney. This mode of building shafts is continued at the present period, and forms one of the grounds for introducing pots, cowls, and a variety of other unsightly contrivances, for the purpose of protecting the mouth of the flues from the effects of obstructed currents of air, created by the unnecessary height and improper form of the shaft: unlike the ancient shafts, which presented angles to divide, without obstructing the course of the wind, the funnels, *&c.*, now in general use, are circular, and are perpetually enveloped in the eddies which their own form is calculated to produce.

Modern chimneys.

Several flues in one shaft.

Chimney-pots, cowls, &c., introduced.

The ancient shafts being deemed indispensable, they were rendered conspicuous features of a building: much care was taken in the workmanship; they were formed of stone or gauged brick-work, with mouldings and projecting cornices; the materials were of the best kind, and put together neatly by small joints of durable cement. The modern terminations of chimneys in general are built of bricks of a very ordinary and porous quality, worked with thick joints of common mortar; the interior of the flue, therefore, is necessarily protected from the effects of the atmosphere by the perishable substance called pargetting, already described. The ancient chimney did not appear to require the aid of cowls, vanes, or other protections, to the mouth of the flue, for the shaft terminating with a projecting cornice, the top was consequently sloped or weathered, to carry off rain water; and although the material utility of this system might not at that period have been known, yet it is quite obvious, that the wind striking on the slope or weathering, took an ascending direction, and thereby assisted the emission of the smoke; and it may be assumed

Ancient termination of chimneys.

Modern termination of chimneys.

Pargetting.

Sloping or weathered tops of chimneys.

Elevated ancient shaft intended for low buildings.

that the elevated shaft was originally intended for low buildings only, or that the architects were not aware of the advantages to be derived from sloping the top of the chimney. The line of ascension applied to the top of the newly-invented chimney, is calculated to permit the largest body of smoke to escape out of the flue, without impeding the course of the wind, and the angle whereby this effect is produced will be found to be fully exemplified by the annexed diagram.

Angle of ascension exemplified.

Diagram.

Starling of a bridge.

Suppose fig. 4, plate 2, to be the starling or cutwater of one of the piers of a bridge; the arrows denote the course of the stream divided by the cutwater; each division on regaining its original current, forms an eddy or curl, as at *a*. The water within the line, denoted by the arrows, is comparatively smooth, and a boat made fast at *b* would not be much affected by the rapidity of the stream. Turning up the fold of the paper, the diagram will exhibit the termination or shaft of the newly-invented chimney, the summit of which appears to assume, geometrically, the exact form of half the plan of the starling. The line of the wind's

Line of Wind's ascension.

ascension is shewn by the arrows, and under that line the smoke is seen to escape without obstruction. The wind in its transit upwards producing a quick exhaustion of the air within the chimney, causes the smoke to be emitted with a velocity in proportion to the force of the wind from whatever quarter it may blow.

The advantages to be gained by the application of the patentee's invention having been described, the facility of construction is fully exemplified in

PART THE THIRD,

Which contains a Series of Definitions, and the first Principles for instructing Workmen.

DEFINITIONS.

Patent circular bricks.

THE flues and cavities are built of bricks of a peculiar shape, as described in plate 3, fig. 1, A and B. Four of these bricks form the circular flue (as fig. 2, A. and B. in plate 3), and the external angles, as they connect with the surrounding brick-work, leave spandrills or cavities for the confined warm air. (See *b b b b*, plate 3, fig. 5.) Any one course or set of these

Spandrills or cavities.

bricks, viewed as illustrated in plate 3, fig. 4, A, take a regular radiated wedge-like form; two courses, laid one upon the other reverse ways, as in fig. 4 B, plate 3, are equal in height or depth to two courses of common brick-work. Courses continued so to be reversed will produce a perpendicular circular flue, as at *a a a*, in fig. 4, C, plate 3; whereas, if placed with the thick ends of the course of bricks or wedge together on the left, as at *b b b b*, the circle or flue will gather over regularly to the right; and then, by placing the thick end on the right, as at *c c c c c*, it will again become perpendicular, as *d d d d*; and if continued to be placed with the thick ends to the right, as at *e e e e e e e*, it will in such case gather to the left, and then, by alternate placing, as at *f f f*, it may be continued horizontally.

Perpendicular flue.

Mode of gathering to the right or to the left.

Horizontal flue.

The vertical joints and external angles are so contrived as to break bond at every course, as shewn by the mortar joints in figs. 2 and 4, plate 3.

Bond broken at every course.

These circular flues and cavities, or warm-air chambers, are built within the usual thickness of walls, that is to say, the present common

Patent flues built in walls of usual thickness.

flue of fourteen inches by nine is contained in a wall of two bricks in thickness (see fig. 8, plate 3), and by the use of the patent bricks, a circular flue of ten inches in diameter can be contained in the same space. (See figs. 3 and 5, plate 3). On the other hand, if the flue be required to be of twelve or fourteen inches diameter, the wall must necessarily be half a brick thicker, as in the case of a common flue of fourteen inches square.

Club-bricks.

This is effected by means of bricks nine inches in length, two and an half inches in depth, and two inches thick, called club-bricks, in addition to the circular bricks before mentioned. These club-bricks (see *a a a a,* fig. 3, plate 3,) will bond in with the building bricks *b b b b,* and the whole will consequently be incorporated with the common brick-work. There is also another description of material, called a quoin-brick, which is particularly applicable in constructing external flues. (See *a a a a,* fig. 3, plate 4.) The face of every club-brick is marked or stamped for the purpose of denoting the course of each flue, nevertheless the rim of the flue, being in two thicknesses (see *a a a a,* fig. 5,

Bond in with common bricks.

Quoin bricks.

Interior of flue protected from injury.

plate 3), the interior circle is essentially protected from those injuries to which the outside face of the wall may be exposed*.

On reference to plate 3, figs. 3 and 5, it will be observed that each flue is protected by hollow spandrills or warm-air chambers, worked as air-tight as the nature of brick and mortar will allow.

Warm-air chambers.

The air-chambers commence at the back of the fire-place (as at *d d*, figs. 9 and 10, A and B, plate 3,) and surround each circle (see figs. 3 and 5, plate 3); they are also connected with those of the adjoining flue by spaces occasionally left in the brick-work, as at *cc*, fig. 5, plate 3.

Air-chambers connected.

Back of bricks bevelled.

The back of some of the bricks being formed with a bevel, the air is conducted round the entire circle. (See *a*, fig. 4, B, plate 3.)

The flues and air-chambers are continued up in the manner before described to the line of coping or top of the wall within which they are built, as shewn in plate 1, and instead of the usual brick chimney shaft above the roof, a cylinder of cast iron, about two feet in height, of a diameter equal to that of the flue, and capable of being heightened as circumstances may require, is placed thereon. (See fig. 1, B, plate 4.) This cylinder is enclosed by a small shaft of an hexagonal form consisting of gauged club-bricks or of stone (see fig. 2, A and B., plate 4), leaving spandrills or spaces open for a continuation of the warm air round it, as at *a a a a*, plate 4. The air-chambers are then covered and enclosed by a stone capping, rabbeted and fitted to the top of the iron cylinder, as shewn by fig. 1, A. and B, plate 4.

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* Carpenters and joiners should carefully avoid driving plugs or otherwise disturbing the brick-work near these flues.

Plumbers should also be cautioned when fixing pipes, not to drive wall-hooks or spikes into any joint of the brick-work, connected with the flue or air-chambers.

Bricklayers also, should be prohibited from cutting putlog holes near the course of the flues.

Cylinder of cast iron.

Hexagonal shaft.

Air-chambers enclosed

The principle of this invention may be applied with a certain good effect to the bottoms as well as to the tops of chimneys already built, and the mode in which this can be effected will be found fully described in a subsequent part of this Treatise.

Principle may be applied to chimneys already built.

It may be imagined by persons unacquainted with the science of building, that a wall can be easily erected by the mere operation of placing one brick upon another, whereas great care is requisite to produce solidity and safety, and the skill and attention of the workman will always be evident by the appearance of the work. The foregoing remark will equally apply to the mode of working the patent bricks, for without due attention to the rules laid down, the work must necessarily be deteriorated.

Solidity of workmanship.

Each flue being constructed upon the same plan, the workman, by an attentive observation of the progress of one chimney, will become sufficiently acquainted with the general principle of the invention to enable him to proceed without difficulty, and for his further guidance and information the Patentee has prepared the following

RULES AND INSTRUCTIONS.

Implements, in Addition to those ordinarily used in working common brick Flues.

Trammel.

A painted wooden trammel or mould for a flue of each diameter.

Mould.

A circular board or mould for a flue of each diameter.

A skeleton mould for working the hexagonal shaft. Skeleton mould.

A small pointing trowel for the circular joints, and Pointing trowel.

A water brush.

MATERIALS.

Provide two quantities of fine stone-lime mortar; one quantity for the inside circular brick-work, and the other for the external face of the wall. Mortar.

The mortar for the inside flue is to be prepared, mixed with smiths' ashes sifted.

The bricks which form the circle of a flue ten inches diameter are numbered 1, 2, 3, 4, and 5. (See fig. 2, A and B, plate 3.) Bricks for circle 10 ins. diameter.

A sufficient number of these bricks, a quantity of club-bricks, and common building bricks, should be in readiness upon the scaffold.

A bucket of water should also be near to the work, in which the bricks are to be dipped, before the labourer hands them to the bricklayer.

The labourer is to be cautioned not to injure Caution to labourers.

or break the interior circular edges of the bricks when stowing or handling them.

Mode of building a Chimney with a Fire-place about three Feet high from the Hearth to the Bar, with a Flue of ten Inches in Diameter, similar to those described in Plate No. 1.

First course of bricks for fire-place.

LAY the first course of bricks forming the whole thickness of the wall (as shewn by fig. 9, A. in plate 3), taking care that the two bricks which form the semi-circle are those numbered 1, with the thick ends of each towards the front, and the thin ends wedged up as at *c*, fig. 5, plate 4, until the front and back become exactly perpendicular, as shewn by *a a* and *b b*, fig. 5, plate 4.

Stone ash back.

The course of circular bricks must be laid at least one inch below the level of the hearth or floor, for the purpose of admitting the thickness of a stone ash back, which will be cut circular, and placed in a direction sloping upwards from the back edge of the hearth, as shewn by *d*, fig. 5, plate 4; and by *c*, fig. 4, plate 4.

Lay the second course of bricks as shewn by fig. 9, B, in plate 3, taking care that the two bricks which form the semi-circle are those numbered 2, with the thin ends of each towards the front.

Second course of bricks for fire-place.

These two courses laid alternately, will produce a perpendicular joint at the back of the semi-circle, as at *a a*, figs. 9 and 10, A and B, plate 3, as well as in the front, adjoining the club-bricks on each side, as at *b b b b*; but care must be taken to secure the joint at the back of the semi-circle by a brick placed so as to break it horizontally, as shewn by *c c*, figs. 9 and 10, A and B, plate 3, which figures being plans of the two courses, also shew the bonding of the surrounding brick-work. By this plan the recess will be two inches deeper than the semi-circle.

Upright joints.

How to be secured.

Bonding of brick-work.

There is also another (and by workmen deemed a better) method of working a fire-place of the same dimensions, so as to avoid the upright joints adjoining the club-bricks in front, and limiting the recess to an exact semi-circle, *viz.*, by cutting off with a grub-saw* two inches

A further method of working a fire-place.

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* Circular bricks and club-bricks prepared for the purpose, are always in readiness at the Depôt of Materials.

from the thicker end of the bricks, No. 1, except those of the thirteenth course, thereby leaving a toothing to connect the semi-circle with the club-bricks, as described by figs. 10, A and B, plate 3, which figures also shew the bonding of the surrounding brick-work according to this plan.

Suppose, therefore, the height of a fire-place to be about three feet to the chimney-bar, carry up thirteen alternate courses of brick-work as before described, the thirteenth course of the semi-circle being formed of two of the bricks numbered 1, as at *g*, fig. 5, plate 4.

On the back joint, and exactly breaking bond, place one brick, No. 3, and on each side of that brick, and adjoining thereto, place a brick, No. 4. (See fig. 11, plate 3.)

Corbel course.

First course of entire circle.

The ends of these two bricks, No. 4, which project beyond the face of the two front club-bricks, form corbels for the support of the first course of the entire circle above (see fig. 12, plate 3); but as the first course of the entire circle has its bearing in front on the chimney-bar, it is advisable that the projecting ends of the two bricks, No. 4, should be cut off.

This circle is produced by two bricks numbered 1, placed at the back, and two bricks, numbered 2, placed in the front, resting on the chimney-bar (see fig. 12, plate 3), which bar must be previously fixed with the ends bearing upon the jaumbs in the usual way. (See *d d*, fig. 4, plate 4.) The bar may be made level, and not cambering*.

Chimney-bar.

Soffit of fire-place.

To form the soffit of the fire-place over the hobs, lay a course of building bricks flat, heading outwards, resting in front on the chimney-bar at *a*, and the other ends upon the brickwork forming the back of the hob at *b*, fig. 6, plate 3.

Soffit varied.

This, however, may be varied, and the soffit made to form a cove by introducing a course of circular bricks, with one end resting on, or springing from, the brick-work at the back of the hob as at *a*; the other end butting on the side of the club-brick bedded upon the bar, as at *b*, fig. 7, plate 3. †.

Description of trammel.

In order to proceed in the construction of the entire flue, the bricklayer is provided with a wooden mould or trammel, formed and painted to represent four bricks, jointed on each side so as to break bond at every course.

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* Workman's term.

†. vide Supplement.-

The first course of the whole circle being laid in the manner described, bedded with mortar, and resting on the bar in front, the trammel is to be placed thereon with the numbers 3, 4, and 5 upwards, and the thickest edge of the trammel in front, by which it will be observed that the next course of circular bricks required, will consist of one brick No. 3, two bricks, No. 4, and one brick, No. 5. Take off the trammel, and place those bricks in the same order, they were represented on it. Let these also be properly bedded in mortar, and then reverse the trammel so that the numbers 1 and 2 shall appear upwards, still with the thickest edge in front. Take up the trammel, and place four bricks, *viz.*, two of No. 1 and two of No. 2, with the thickest ends of No. 2 in front, according to the foregoing directions. These, being bedded, turn the trammel with the numbers 3, 4, and 5, upwards, and the thinnest edge in front. By this it will appear that the next course will require a brick of No. 5 in front, one of No. 3 at the back, and one of No. 4 on each side.

Method of using trammel.

Flue brought into centre of wall.

This operation must be repeated as often as may appear requisite, in order to bring the flue into the centre of the wall, and the course nearly level; then, if the flue is to be gathered over to the right or to the left, the thickest edge of the trammel must be placed to the right or to the left as the case may be: this is particularly described in page 16, and the plate and figure therein referred to, *viz.*, fig. 4, C, plate, 3.

The bricks, Nos. 3, 8, or 13, as the case may be, being in their form nearly parallel, may be used alone if preferred, instead of the regular numbers, in all cases where the flue is to be built perpendicularly or horizontally*.

Courses to be regular and smooth.

Great care must be taken that every course when bedded should lay regularly and smoothly, resembling in evenness, as nearly as possible, the trammel itself; for an irregularity in any one course will essentially affect the course above, create uneven and wide mortar joints, and thereby render the work unsound.

Internal joints to be drawn with a pointing trowel.

The internal joints should be carefully and smoothly drawn with a small pointing trowel, and lightly touched round with a water-brush, to prevent any roughness of joint, and all possible caution should be observed not to smear or damage the glazing. The mortar to be used should be of a proper consistency and equally fine as putty. The circular board should be applied, in order to keep the circle true at every course, and the four upright joints of each course must be kept of a regular thickness. The bricklayer should be instructed that the square back of the circular brick is to be placed immediately against, and parallel with, the back of the faced brick of the wall, as at *a a a a*, fig. 5, plate 3.

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* The only objection to this mode is, that the horizontal joints of the circular work will be parallel with those of the outside facing, and, consequently, the whole will not be so substantially united.

Mortar to be as fine as putty.

Joints to be of equal thickness.

Bevelled backs of bricks not to be considered mortar joints.

It will be observed that the back of some of the circular bricks is bevelled off so as to connect the air of one spandrill or air-chamber, with another, as at *a*, fig. 4, B, plate 3, consequently must not be filled up or considered a mortar joint. The mortar which is pressed out of the joints, next the air-chambers, instead of being scraped off with the trowel, should be spread upon each edge of the brick to form a key, and if the air-chamber could be entirely lined by a thin coat of mortar, it would be an improvement; nevertheless, care should be taken not to fill up or reduce the spandrills unnecessarily.

Spandrills not to be reduced unnecessarily.

When two or more flues are to be built in one stack, spaces must be left at every second or fourth course so as to unite the air-chambers of each flue, as shewn by *c c*, fig. 5, plate 3; and if the joint in every other course be left free from mortar, a similar effect will be partly produced as at *c c*, fig. 3, plate 3. The divisions between the several flues in a stack must necessarily vary in their progress according to circumstances; several examples in illustration of this point will be remarked on plan of flues, fig. 3, plate 3, referred to in the section, plate 1.

Air-chambers united.

Divisions between the flues.

It may be proper also to remark, that if the instructions given for bonding the work be strictly attended to, the walls in which these flues are built, will be equally substantial and secure, and, perhaps, more so, than the common and ordinary brick-work of the flue in general; but as it is considered wise to be a little stronger, than strong enough, it may be expedient, when several flues are carried one

Flues carried one over another.

over another in nearly a horizontal direction, to introduce bond-stones occasionally to unite the two faces of the wall.

Bond-stones to be introduced.

Dimensions from centre to centre of flues.

When the flues are within a few feet of their intended height, they must measure exactly one foot ten and a half inches from the centre to the centre of each circle, and nine and a quarter inches from the centre of each end-circle to the outside of the brick shaft, that being the distance required for the stone bases of the terminations of the chimney, as shewn in fig. 3, plate 4.

Should the brick circles require five inches to bring them to their height, two regular courses of circular bricks will be necessary, which in height or depth are equal to two courses of common brick-work.

If they require only a space of four inches, it may then be worked up by a course of bricks numbered 3; if the space should be less than four inches, the deficiency can be supplied by one or two courses, as the case may be, of bricks, No. 5, assisted by tile-heads or slates carefully worked to the circle and bedded in mortar.

The requisite turning up of the lead flat or gutters, as well as the flashing, instead of being dressed into the horizontal joints of the brickwork, as is usual, should be properly bent and fitted ready to be worked into the joint, lest the operation of dressing the lead should shake or damage the external two-inch face of the air-chambers. The brick-work need not be carried up higher than eighteen inches above the flat or gutter, previous to setting on the stone finishing, the bed or bottom of the plinth of which may range with the underside of the coping. (See fig. A.and B., plate 4.)

Lead flashings not to be dressed into joints.

Height of brick-work above flat or gutter.

The outside rims, divisions, and internal circles, being thus brought to their exact height, to an entire level, and to their exact distances, *viz.*, one foot ten and a half inches from centre to centre of each circle, the next operation is setting on or fixing the termination or upper shaft of the chimney.

Fixing shaft of chimney.

The lower iron cylinder, having a flanche* two inches wide, must be bedded and fixed perfectly upright and level upon the top of the brick circle (see *a a* fig.1, B, plate 4); the outside and the inside of the bedding joint must

Lower iron cylinder.

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* Workman's term.

be neatly drawn and pointed, keeping the air-chambers free from loose mortar or other obstructions; then set on the stone base which is dished out and hollowed on the underside to preserve a continuation of the warm-air chambers round the cylinder. The stone base has a regular projection of about two inches over each face of the wall. The underside of the projection must be previously properly throated in like manner as coping or other stone-work. The termination assuming the form of a pedestal (see fig. 1, A, plate 4), the die or plain part of the pedestal, *a,* may be either of brick or stone, whichever will accord with the front of the building. If of stone, it is made of ashlering two inches thick, with upright joggle joints, properly cramped and run with cement; if of brick, it requires five courses of properly gauged club-bricks, set in fine mortar, with a neat flat joint. Special care must be taken in setting either the stone or brick die, that the six spandrills be kept open and free from mortar for a further continuation of the warm air round the upper cylinder (see *a a,* figs. 2, A and B, plate 4), which upper cylinder is cast

Stone base.

Pedestal form.

Brick or stone die.

Spandrills to be kept open.

Upper cylinder.

with a circular rabbet to fit upon the upper edge of the lower cylinder. (See *b*, *b*, fig. 1, B, plate 4.) A little cement is requisite in the said rabbet to make the joint of the iron perfect: the foregoing, if properly performed, should leave about two inches of cylinder in height above the stone or brick-work, to fit into a circular rabbet cut in the underside of the stone capping. (See *c c*, fig. 1, B, plate 4.)

Stone cap.

The stone cap must then be firmly bedded and pointed, and the top of the cylinder cemented into the rabbet, so as to close up entirely the spandrills or warm-air chambers. Too much care cannot be taken in fixing the stone cap, to prevent injury to the sharparrises *, as the protection of the mouth of the chimney from strong currents of air depends upon the accuracy of the angles. Whenever it may be necessary to carry the shaft of a flue to a greater height than two cylinders †, it may assume another figure on the plan; *viz.*, the two opposite angles of the hexagon can be extended so as to acquire a more substantial footing upon the base. (See *b b*, fig. 2, B, in plate 4.)

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* Workman's term.

† This will sometimes be requisite when the mouth of a flue approaches too near a window.

Termination of all chimneys similar.

The terminations of all chimneys of whatever diameter the flues may be, are to be similar; consequently a flue of twelve inches diameter, must, within a short space from the top, be reduced to ten inches in diameter; and according to the same rule, if a flue be fourteen inches in diameter, it must be successively reduced to twelve inches, and then to ten inches.* This progressive reduction is effected by the use of bricks prepared for the purpose, in the form of the mouth of a trumpet inverted, as exemplified by fig. 7, plate 4.

Bricks in the form of the mouth of a trumpet inverted.

The foregoing instructions relate entirely to the building of a flue of ten inches diameter within a wall of two bricks, or one foot six inches in thickness. If, therefore, the wall should be two bricks and a half, or one foot ten and a half inches in thickness, in that case two club-bricks, with a space of half an inch between them, must be used for the facing (see fig. 8, plate 4), instead of the single club-brick as already directed. These instructions will also apply to flues of twelve or fourteen inches in diameter, built in a wall of two and a half bricks, or three bricks in thickness, by observing that in a twelve-inch flue, the five bricks

Wall one foot six inches in thickness.

Wall one foot ten and a half inches in thickness.

Flues twelve or fourteen inches in diameter.

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* vide Supplement. —

numbered 6, 7, 8, 9 and 10, correspond with the bricks numbered 1, 2, 3, 4 and 5, in working a flue of ten inches in diameter; and again, that the five bricks used in a flue of fourteen inches in diameter, being numbered 11, 12, 13, 14 and 15, are applied in a manner precisely similar to the mode in which a flue of ten inches or twelve inches in diameter is constructed. (See fig. 9, plate 4.) The instructions at pages 22 and 23 relate to the mode of forming a fire-place with a semi-circular back of ten inches in diameter.

Fire-place backs twelve or fourteen inches in diameter.

When a semi-circular back of twelve or fourteen inches in diameter is preferred, and a flue of ten inches only in diameter is necessary, the bricks numbered 6 and 7 for the semi-circle of twelve inches, and the bricks numbered 11 and 12 for the semi-circle of fourteen inches in diameter, as the case may be, are to be used and applied, in a manner precisely similar to the mode in which the bricks numbered 1 and 2, are used in the construction of a semi-circle of ten inches in diameter. (See figs. 9 and 10, A and B, plate 3.

The thirteenth course of bricks in a semicircle of twelve inches in diameter, will necessarily be two bricks numbered 6; and in the semi-circle of fourteen inches in diameter, the bricks forming the thirteenth course will be two, numbered 11; consequently the course of bricks forming the corbel to the whole of the circle of twelve inches in diameter, will be one brick, No. 8, and two bricks, No. 9; and the course forming the corbel to the whole circle of fourteen inches in diameter, will be one brick No. 13, and two bricks No. 14.

Corbel course.

Mode of reducing a flue of twelve inches in diameter to ten.

The first course forming the entire circle of twelve inches in diameter, is produced by two bricks No. 6, and two bricks No. 7, with the latter in front. The next course, by one brick No. 8, two bricks No. 9, and one brick No. 10, with the brick No. 8 in front, on which course must be placed two bricks No. 2, and two bricks No. 1; which being prepared for the purpose in the form of the mouth of a trumpet inverted, will reduce the flue to a diameter of ten inches, as at *a a*, fig. 6, plate 4.

Mode of reducing a flue of fourteen inches diameter to twelve and ten.

With reference to the back of a fire-place with a semi-circle of fourteen inches in diameter, the first course of the entire circle will be produced by two bricks No. 11, and two bricks No. 12, with the latter in front; and the next course by one brick No. 13, two bricks No. 14, and one brick No. 15, with the brick No. 13 in front, on which course should be placed two bricks No. 6, and two bricks No. 7; which being prepared in the form of the mouth of a trumpet inverted, will reduce the flue to a circle of twelve inches in diameter, as at *e e*, fig. 5, plate 4.

The next course will be, one brick No. 8, two bricks No. 9, and one brick No. 10, with the latter brick in front, on which course must be placed two bricks No. 1, and two bricks No. 2, prepared in the form of the mouth of a trumpet inverted, to reduce it to a circle of ten inches diameter, as *f f*, fig. 5, plate 4.

Method of reducing diameter of flues may be varied.

The foregoing appears to be the most direct method of reducing the diameter of a flue, and at the same time gathering the flue back into the centre of a wall, eighteen inches or two bricks in thickness; but if the wall should exceed two bricks in thickness, or if the gathering of the flue into the centre of the wall so quickly be not considered essential, the operative bricklayer, in such case, may vary the courses, and reduce the diameter as his judgment (which he may acquire by the practical application of the foregoing rules) will point out.

Chimneys built back to back.

When chimneys are required to be built back to back, the one must be gathered to the right, and the other to the left, so as to gain the centre of the wall as quickly as possible before they take their required direction in the chimney-stack. (See fig. 10, plate 4.) In regard to kitchen chimneys, when a smoke-jack may be desired to be affixed, the circular flue will commence immediately above the fly, according to the directions prescribed for constructing and reducing the diameters of flues. *

Patent can be applied to tops of chimneys already built.

To apply the principle of the patent to the tops of chimneys already built, it will be necessary to take down the brick-work as low as possible, *viz.*, to the back of the fire-place of the upper story: but if that should be inconvenient, then through the roof to the ceiling floor, or about three feet below the lead flat, which may effect the object intended.

When the brick-work is removed, it is requisite by cutting away and dubbing out with

* vide Supplement.

Square flues to be reduced to a circle.

tile-heads and cement, to reduce the square flue to a circle.

Flue of fourteen inches diameter reduced to twelve or ten

If a flue of fourteen inches square be dubbed out to a circle of fourteen inches, begin with a course of fourteen inch circular bricks, and gradually reduce the circle to twelve, and thence to ten inches diameter, in the manner already explained,* by using bricks in the form of the mouth of a trumpet inverted. (See fig. 7, plate 4.) When the flue has been reduced to a diameter of ten inches, the work is to be carried up to a height of eighteen inches above the roof or lead flat, as in the case of a new chimney, placing thereon a brick or stone terminating cap, agreeably to design before referred to in plate 1, and in plate 4, fig. 1, A.

Patent can be applied to lower part of chimney and fire-place.

To apply the principle of the patent to the lower part of the chimney and fire-place already built, the following directions are to be observed:—

The operation should commence as high up the flue as the workmen can reach with convenience. The square flue is to be dubbed out to a circle. Slight iron bars are then to be placed across the chimney to support the circu-

* vide Supplement.

lar brick-work, which must be underpinned from bar to bar, so as to contract the gathering wing, by bringing the circle down to rest on the same description of chimney-bar as that shewn by *d, d,* fig. 4, in plate 4.

The semi-circular back of the fire-place must then be worked up in the manner specified in pages 22 and 23, until it unites with the circle above. The whole will correspond as nearly as possible with the new fire-place described in plate 4, fig. 4 and 5.

In all cases where the principle of the invention is applied to old chimneys, it is advisable that the upper part should be finished first, taking care, however, that the register flap (where a register-stove is fixed) be removed before the workmen begin, and the fire-place should of course be secured by a chimney-board with paper pasted over the crevices.

It will also be necessary that the flue should be cleared from any bricks or rubbish that may by chance have lodged or accumulated before the workmen begin the lower part of the chimney.

It is contrary to the principle of this invention to imagine that the smoke will freely ascend through the flue until the work is perfectly dry and seasoned, which will require a lapse of some weeks, unless the work shall have been performed during the summer.

Flues must be dry before the smoke will ascend freely.

Plate 1, represents several chimneys upon the same level, as well as those in an ascending direction upon the roof. (See figs. 1 and 2.)

Flues on the same level, or in an ascending direction.

Where flues are carried through the middle or ridge of the roof, it is desirable that the shafts should be arranged one above another, according to the pitch of the rafters (see fig. 1, plate 1): in such case the points of the hexagon *a, a,* fig. 4, plate 1, will be at right angles with the ridge of the roof; but when the shafts are upon a level with each other, as in fig. 2, plate 1, the points of the hexagon *a, a, a, a,* fig. 5, plate 1, are required to be exactly the reverse.

If the appearance of the summit of the shaft should not be a matter of objection, flat copper tilts might be affixed, for the purpose of preventing the descent of rain or snow down the flue. These tilts, if placed at a proper altitude, will not impede the free egress of the smoke, and can be removed with facility whenever it may be requisite to cleanse the chimney.

Copper tilts or coverings.

Stoves may be altered at a trifling expense.

The grates or stoves at present in use, can be made applicable, at a trifling expense, to the new fire-places. A cast-iron back, of peculiar construction, is recommended to be affixed to the stoves, instead of the common backs.

The cast-iron back can also be affixed to kitchen ranges, but when steam or any culinary apparatus requiring space is attached thereto, considerable ingenuity will be necessary to prevent impediments to the free ascent of smoke in flues which are badly constructed.

The backs above recommended are made of three different sizes, in accordance with the dimensions of the three semi-circular fire-places, and may be procured at the depôts of the patent materials, prepared for fixing.

Plans prepared require no alteration

The flues, according to the foregoing principles, can be introduced into buildings, the designs or plans for which have been already prepared, without rendering alteration at all necessary; but it is not by any means intended to dictate to architects the precise dimensions of fire-places, height of shaft, or any other minutiæ contingent upon taste or convenience, the whole of the foregoing remarks, explanations, and instructions, being stated as the result derived from experience in the practical application of the general principles of the patent.

It is however to be observed, that in all cases the architects should exercise their judgment in regard to the requisite dimensions of the flues, as well as of the semi-circular backs of fire-places; the lesser diameter of the semi-circular backs being applicable to the inferior, and the larger diameter to the superior, apartments of buildings.

Patent flues, expense of constructing.

Adverting to the expense in constructing these patent flues, it may with propriety be remarked, that the actual cost cannot be a consideration, when compared with the saving which will accrue from the general adoption of this mode of building chimneys; for among the advantages and consequent diminution of expense, may be enumerated the following, *viz.*:

Bricks, kiln-burnt.

The introduction of a hard, durable, kiln-burnt brick, instead of clamp-burnt bricks; the softest of which are generally selected by workmen for the facility in cutting.

Projection of chimney breast.

The customary projection of the chimney-breast into the room, can, in many instances, be entirely dispensed with.

Pargetting not required.

That no sort of pargetting or inside plastering is required:

Lofty shafts avoided.

And that the lofty shafts, with their pots, cowls, and whimsical contrivances, are avoided: added to which the perpetual decay of the mortar, the expense of the scaffolding, and the repairs of the shafts.

No expense of scaffolding

With respect to the substitution of the newly-invented termination of chimneys, for the very lofty, inconvenient, and dangerous shafts, so conspicuous in every part of this metropolis, it is obvious that by the reduction of them to within a proper and limited distance or height from the roof, facilities are afforded for cleansing by the aid of machinery, instead of climbing boys *.

Facility of cleansing.

Mode of cleansing.

A further advantage might accrue by the adoption of an improved method of preventing the spreading of the soot in apartments during the process of sweeping, instead of the square

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* Circular brushes and machinery have been prepared for the purpose of cleansing the patent flues, aud can be obtained at the Depôt of Materials.

cloth usually affixed to the fire-place by means of forks or nails, which are frequently thrust into the joints of the marble.

The method alluded to is the substitution of a sack with a hoop fixed to the mouth of it, and fitted to the circle of the flue. The sack should be made of a material through which the soot could not escape. It follows, of course, that the patent chimneys are always susceptible of cleansing from their summit.

Ventilation of chambers improved.

Descent of smoke of adjoining chimney prevented.

The current of air or draft through the flue being accelerated by the principles of this patent, chambers become better ventilated, and free from unpleasant smells or effluvia, or smoke of adjoining chimneys; and sleeping apartments, particularly, are rendered more salubrious. Should small particles of soot, by any accident, accumulate and descend, they must necessarily fall at the back of the fire-place, and not upon the hobs or slabs, which frequently occurs under the old mode of construction; this point is exemplified by the sections, figs. 5 and 6, in plate 4.

To any person observing the mode of working one of these flues, it will at first appear that

Time occupied in building patent flues.

the time occupied is greater than that which is required to construct one of the common chimneys; but when the loss of time in building the latter, occasioned by cutting bricks, waiting for stone and iron-work, and other unavoidable impediments are considered, the preference will be given to the new system detailed in this publication.

The object of the patentee is to bring into general use a form of material by which the labour of workmen can be simplified, and at the same time to introduce a systematic plan for effectually preventing the annoyance of smoke in rooms, and otherwise removing those domestic inconveniences incidental to the present mode of constructing chimneys (rendering unnecessary the assistance of climbing boys in cleansing them), as well as to improve the external appearance of buildings by causing the removal of lofty shafts *&c. &c.*, which not only offend the eye, but threaten destruction, in boisterous weather, to every person passing the streets, particularly in a crowded metropolis.

PARTICULAR

CAUTION TO BRICKLAYERS.

The bricks are not to be thoroughly soaked in water; the top and bottom beds, and each end only of every brick should be lightly dipped, or just sufficiently wetted with a water-brush, to secure adhesion with the mortar, (see page 21;) for the patent flues will not act whilst any damp remains in the pores of the material. (See pages 40 and 41.)

APPENDIX.

TABLE I.

MATERIALS requisite for constructing Chimneys according to the Principles of Mr. Hiort's Patent, with the present Price of each Article.

			s.	*d.*
Flue of ten inches in diameter		at per foot lineal or running	3	0
Ditto of twelve	ditto	ditto	4	0
Ditto of fourteen	ditto	ditto	5	0
Gauged brick hexagonal shafts		ditto	3	8
Joggled Bath-stone	ditto	ditto	12	0
Club-bricks		at per M.	73	6
Ten-inch circular bricks cut for backs		at per C.	30	0
Twelve	ditto	ditto	36	0
Fourteen	ditto	ditto	42	0
Club-bricks	ditto	ditto	10	6
Trumpet-mouth bricks, 10 inches in diameter,		at per set	2	0
Ditto ditto 12	ditto	ditto	3	6
Bath-stone caps		each	30	0
Ditto bases		do.	35	0
Cast-iron cylinders		do.	12	6

N. B. All Materials are to be paid for when issued from the Depôts, or previously to the next Delivery.

Hours of Delivery from nine till four.

The Depôts in London at present are, Stangate Wharf, Lambeth, and Exchequer Wharf, Old Palace Yard, Westminster.

TABLE II.

EXPLAINING what Number of Circular Bricks will be required for a Flue of each Diameter, with a proportionate Quantity of Club Bricks from one to ten Feet.

Feet lineal or running.	In. of 10 Flue of 12 Flue of 14 Flue	Circular Bricks. No. 1 No. 6 No. 11	Circular Bricks. No. 2 No. 7 No. 12	Circular Bricks. No. 3 No. 8 No. 13	Circular Bricks. No. 4 No. 9 No. 14	Circular Bricks. No. 5 No. 10 No. 15	Total Number of Circular Bricks.	Club Bricks.
1	. . .	4	4	2	4	2	16	16
2	. . .	8	8	4	8	4	32	32
3	. . .	12	12	6	12	6	48	48
4	. . .	16	16	8	16	8	64	64
5	. . .	20	20	10	20	10	80	80
6	. . .	24	24	12	24	12	96	96
7	. . .	28	28	14	28	14	112	112
8	. .	32	32	16	32	16	128	128
9	. . .	36	36	18	36	18	144	144
10	. . .	40	40	20	40	20	160	160

TABLE III.

CALCULATION of Prices charged by Bricklayers, in London, for Patent Circular Flues in Measured Work, and for Materials in Day-Work.

CLUB BRICKS.

	£.	s.	d.
Prime cost . . . . per M.	3	13	6
Profit, cartage, and risk	1	1	0
Bricklayer's charge in day-work per M.	4	14	6

FLUE OF TEN INCHES IN DIAMETER.

	£.	s.	d.
Prime cost . . . . . . per foot running	0	3	0
Profit, cartage, and risk	0	0	8
Bricklayer's charge in day-work, per foot running	0	3	8
Labour, mortar, and cost of club-bricks requisite for each foot of flue	0	2	7
Value per foot running in measured work (all materials)	0	6	3
Deduct value of brick-work displaced . .	0	2	3
Bricklayer's charge (extra) per foot running, the wall being measured solid according to the general practice	0	4	0

FLUE OF TWELVE INCHES IN DIAMETER.

	£.	s.	d.
Prime cost . . . . . . per foot running	0	4	0
Profit, carriage, and risk	0	0	10
Bricklayer's charge in day-work, per foot running	0	4	10
Labour, mortar, and cost of club-bricks requisite for each foot of flue	0	3	4
Value per foot running in measured work (all materials)	0	8	2
Deduct value of brick-work displaced	0	3	2
Bricklayer's charge (extra) per foot running, the wall being measured solid according to the general practice	0	5	0

Flue of fourteen Inches in Diameter.

	£.	s.	d.
Prime cost . . . . . . per foot running	0	5	0
Profit, carriage, and risk	0	1	0
Bricklayer's charge in day-work, per foot running	0	6	0
Labour, mortar, and average cost of club-bricks requisite for each foot of flue	0	3	4
Value per foot running in measured work (all materials)	0	9	4
Deduct value of brick-work displaced	0	3	4
Bricklayer's charge (extra) per foot running, the wall being measured solid according to the general practice	0	6	0

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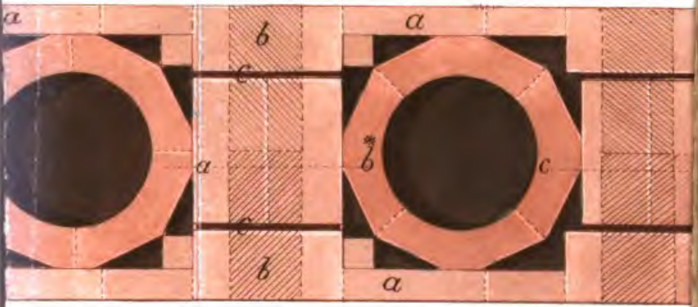

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Fig. 5.

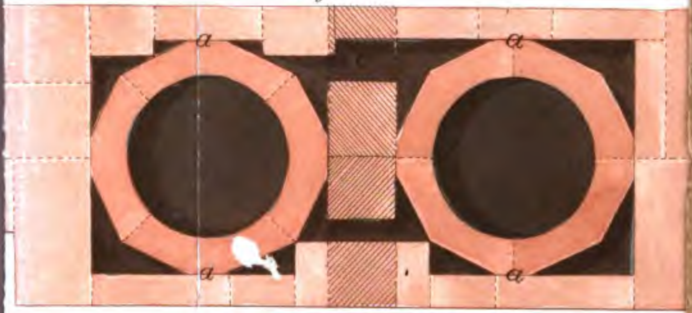
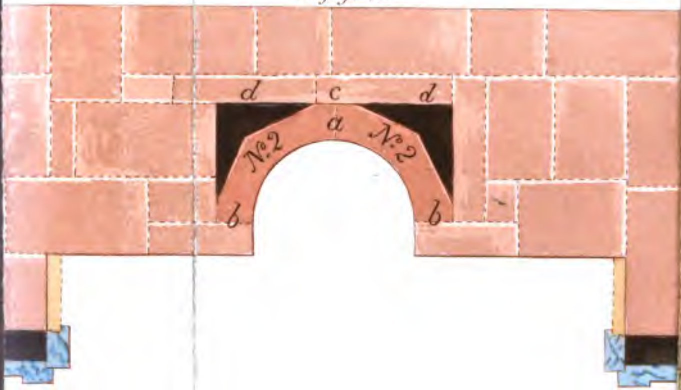


Fig. 9. B.



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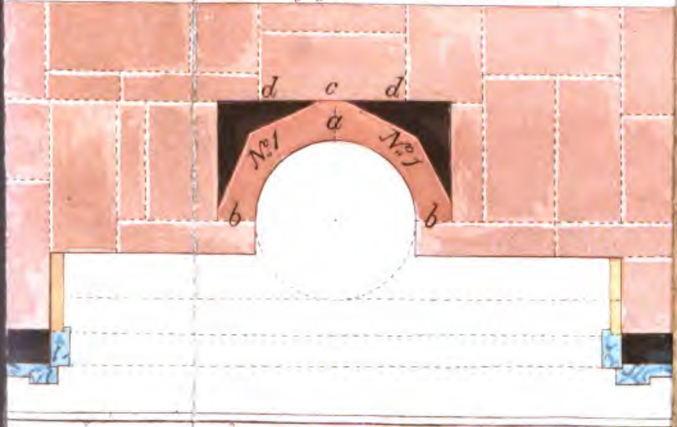

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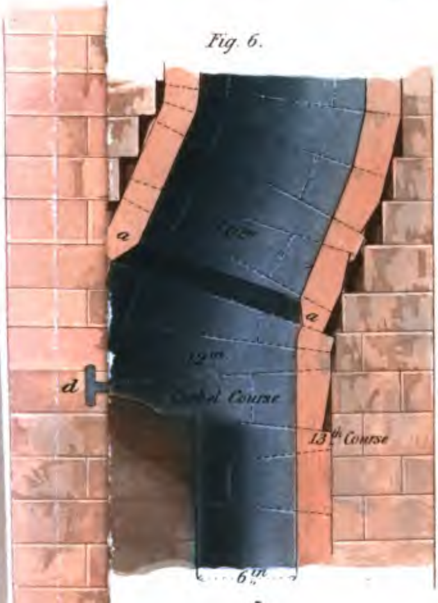
Plate 4.

Fig. 6.



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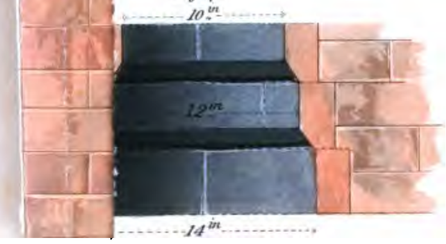

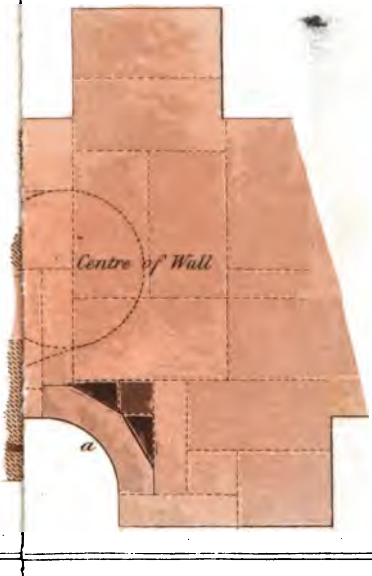

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SUPPLEMENT

TO

MR. HIORT'S TREATISE

ON THE

ARCHITECTURAL

CONSTRUCTION OF CHIMNEYS,

CONTAINING

HINTS TO BUILDERS,

RELATIVE TO

THE PROPER DIAMETER OF FLUES, TO BE INTRODUCED IN THE
VARIOUS APARTMENTS OF HOUSES,

AND

OTHER MATTERS INTERESTING TO PERSONS WHO CONTEMPLATE
BUILDING OR ALTERING CHIMNEYS.

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SUPPLEMENT
TO
MR. HIORT'S TREATISE
ON THE
CONSTRUCTION OF CHIMNEYS.

THE various opinions which have always existed respecting the exact or proper dimensions of flues in general, induced the Author of the above Treatise, to leave to the superior judgment of Architects, the expediency of building a flue in each apartment appropriate to its size, and therefore he has observed, in page 43 of the Treatise, that the lesser diameter of the patent flue, is applicable to inferior apartments, such as rooms on the chamber-story, or attics of houses, as well as lodges, and other low buildings, and that the larger diameters are peculiarly adapted to the superior, or more spacious apartments, such as those in the lower stories of buildings. Notwithstanding the foregoing remarks, the Patentee considers it proper to apprize the Public, that the general opinion seems to be, that kitchen chimneys, in modern-built houses, are, for the most part, found not to be sufficiently large to carry off the great quantity of air contained within the space usually allowed for culinary purposes, the more particularly when the flues of ovens, boilers, *&c.*, lead into the same chimney.

The inconvenience resulting from this deficiency can only be remedied (when the wall of a house will not admit of the construction of a flue of sufficient diameter to carry off the air or smoke,) by building two patent flues for one fire-place, which in the case of a kitchen chimney may commence or branch from the tunnel, containing the fly of the smoke-jack, and terminate with such outlet or outlets as may be deemed suitable by the Architect or builder.

The last remark is offered to the Public in explanation of that part of the Treatise, page 38, which has reference to the mode of building the patent tunnel above the smoke-jack, lest it might be construed, that a flue of small diameter is sufficient for the emission of smoke produced by every sort of kitchen range, without reference to the size or space of the fire-place.

The directions given in page 8 of the Treatise, for commencing the circular flue at the throat of the chimney below the usual line of the chimney-bar, as well as the rules for forming the soffites of fire-places at page 25, and for the terminations and reduction of the size of flues at pages 34 and 39, are (as remarked in page 43) the result derived from experience in the practical application of the general principles of the patent, and are not meant to extend or apply to kitchen or other chimneys requiring large fire-places, which will not admit of being *Rumfordized* or the angles being reduced, according to the method stated in page 8 above mentioned.

The forms of such descriptions of fire-places, and the consequent enlarged diameter of flues, with the size or number of the terminations or outlets, must necessarily vary according to circumstances, and the construction of them must be left to the experience and decision of the Architect or builder, as stated in pages 42 and 43, wherein the precise dimensions of fire-places, height of shafts, and other minutiæ are described as contingent upon taste or convenience.

If it should be observed, when a patent flue of a diameter appropriate to the size of the room has been properly executed, completed and become perfectly dry, that the smoke escapes under the mantle, it will not result from any defect in the construction of the flue, but from the dimensions of the grate, range, or fire-place, not being in accordance with the size of the flue generally, or with the termination or outlet of the chimney; the form of the fire-place also, may not be calculated to conduct the smoke to the entrance of the flue.

In either of the foregoing cases the proper alteration can be made in the stove or fire-place with facility, according to the judgment of the builder, except in a kitchen chimney, where a smoke-jack is fixed, which, possibly, may prevent the entrance of the flue being made to accord with the outlet; in such case, the only remedy is taking down and enlarging the flue or building one in addition.

In reference to the foregoing remarks it may be suggested that no alteration of stoves or fire-places or of any other description whatever should be decided upon or adopted, while there is any reason to suppose that the flue or the surrounding brick-work is in a state of dampness; instances having occurred of the patent chimneys not acting perfectly when first finished, and even after a lapse of several months, although eventually they have succeeded in the fullest extent, it being quite apparent that the rapid expulsion of damp in brick-work, in a great degree, depends upon the season of the year in which the building is constructed, and the thickness of the walls which contain the flues; the drying of the brick-work has however been frequently protracted by the shaft being unnecessarily exposed previously to fixing the lead flashing, or in consequence of the flashing or filletting being improperly executed, so as not to protect the sides of the shaft from floods of rain descending the roof and gutters; also, rain water and other pipes fixed near to flues have been suffered to overflow, whereby the brick-work has been saturated with water.

Cold air, generated by dampness or admitted through the sides of a flue, in consequence of any other cause, by its natural gravity will attract and connect with the atmospheric air, floating at the mouth or outlet of the chimney, and in its descent, overpowering the ascending current, will cause the smoke to be driven back into the room.

Common flues (as described in the Treatise) cannot be supposed to be capable of resisting the effects of casualties of the above description, but it may be asserted with confidence, in regard to the patent flues, that when the work has been properly constructed, the warm-air chambers carefully preserved, and the work generally become perfectly dry, the circle will be impervious to the effects of any of the accidents before enumerated.

In cases where fire-places on the ground floor are contained in walls, the foundations or footings of which are set on a damp or swampy soil, it cannot be expected that the apartment will be wholly exempt from smoke although the patent flue may, in all respects, be entirely perfect and the outlet complete; because the brick-work becomes impregnated with the moisture of the earth in the same proportion as the damp is expelled by the action of the fire, and the air within the throat of the chimney must necessarily, in a greater or lesser degree, be in a continual state of condensation.

It is particularly recommended to persons who contemplate alterations in the chimneys of their houses, with a view to making trial of the Patent flue, that the adaptation should take place in the spring of the year. It frequently occurs that the application of a remedy for a smoky fire-place is deferred until the winter season has commenced, and it is therefore proper to explain, that no beneficial result can be expected within a reasonable period, if the alterations are made in the winter or wet season of the year.

The Patentee does not therefore wish the Public to be deceived by supposing, that the patent bricks worked or made into a flue, can serve immediately as a cure for a smoky fire-place, particularly if exposed to the casualties before specified; although the patent tunnel, when once perfected, will be a perpetual remedy against all the nuisances and inconveniences incidental to vents defectively constructed.

It would be advisable, whenever there may be opportunity, to build extra or spare flues, in convenient situations (especially adjoining kitchens or other offices) which can be at any time, either used separately or attached in aid of fire-places requiring additional vent.

It is not possible to lay down general rules for fixing the precise diameters of flues appropriate for every apartment; this must in a great measure depend upon the dimensions of the rooms, the height of stories, and the purposes for which apartments are intended to be used ; but at all events, builders will be less liable to err in constructing flues of such diameter, as will admit of an enlargement of the extremities as circumstances may render necessary.

The reduction of a flue of 12 inches or 14 inches in diameter, therefore (as directed in pages 34 and 39 of the Treatise) should commence as near to the top of it as possible, so that, in the event of the apartment being converted to purposes requiring a larger fireplace, an enlargement of the mouth or outlet of the flue, may, if requisite, be effected with greater facility, and if an upright mortar-joint be kept in the brick-work between each flue from the commencement of the reduction to the under-side of the stone base, then, in the case of any alteration being necessary in one outlet, the adjoining flue or flues need not be disturbed or damaged.

In answer to inquiries as to the preference given to an outlet of 10 inches diameter, or to two outlets of 10 inches diameter in lieu of one of 14 inches, it may be stated, that one outlet of 10 inches diameter, has hitherto been found adequate to a fire-place of ordinary size; and when the outlet exceeds 10 or at the utmost 12 inches, it may not at all times be protected by the ascending lines or slopes, from sudden gusts of wind, a portion of which is liable to enter a large mouth or outlet, and partially obstruct the ascent of the smoke.

The Patentee wishes it to be inferred from the foregoing observations, that, although a fire-place should be built of a size adequate to any purpose for which it may be required, or proportionate to the dimensions of the apartment it is intended to warm, yet it is obvious that the fire-place should contain no more air, than can be heated by the fuel ordinarily consumed.

Also, that the grate or range should contain no more fuel than is requisite to heat that portion of air, which the throat or entrance of the flue is calculated to admit.

That the throat or entrance of the flue should be so formed as not to admit more air than the outlet on the top of the chimney is capable of discharging, and that the diameter of the outlet ought not to exceed that of the general passage of the flue.

In illustration of the foregoing observations on the proportions of flues, it may be remarked, that a fire-place calculated to contain a certain portion of warm air, and an outlet constructed for the purpose of delivering the same, may precisely bear comparison to a funnel for conducting liquids, which if supplied by pouring in a greater quantity than the tube can discharge, it will of necessity soon overflow.

It having been observed that workmen in constructing the patent flue, carry up the circular tunnel, without the surrounding brickwork, it seems proper to explain, that the square brick-work connected with the flues, and forming the wyths, the warm-air chambers, and the face of the wall, should be built, course by course, together with the circular work (according to examples shewn in plates 3 and 4 of the Treatise), continuing the courses throughout the wall, or bringing forward each course to close to the face work of the flues. But if the circular work be carried up by itself, it may prevent the proper bonding of the wyths, and according to this practice, it would be difficult to build a circular flue exactly perpendicular, or parallel with the face of the work; in such case the face bricks would of necessity require to be cut, to prevent the wall exceeding its given thickness. Hence it must be obvious, that inattention to these points on the part of the workmen, would tend to render the wall less substantial.

As some difficulty has been experienced in removing small portions of mortar, *&c.*, commonly called core, which workmen are apt to let fall into the flue, it is particularly recommended that a wadding or stopper, made of coarse cloth stuffed with hay, and attached to a short rope, should be kept in each flue during the progress of building them, and occasionally raised; by this mode, the substances accidentally dropped, cannot descend, nor adhere to the sides of the flue, and may be easily removed. The like recommendation is equally requisite in cases where the principle of the Patent is applied to the tops of old chimneys; and lest the above caution should have been disregarded, it will be always desirable to examine the flue from bottom to top before any trial takes place, it having frequently occurred that a chimney has been pronounced to be defective when in fact an impediment to the free ascent of the smoke has been found to result from an accumulation of rubbish which the workmen have carelessly suffered to fall down during the progress of building.

The Patentee without any intention of dictating to Architects, considers it necessary to publish his opinion upon these particular points, lest any inconvenience, arising from inattention or want of judgment in the builder, may be attributed to a defect in the principle of the patent flues, feeling persuaded that an adherence to the rules laid down generally in regard to the mode of constructing them, will prevent the possibility of any failure in the application of the Patent; and the best proof of this assertion is, that as the patent flues, by their anti-condensative properties, are admitted to be the ground work of a remedy against all the evils incidental to the common or modern method of constructing vents, the Author fully believes, that on strict examination of every defective chimney, it will be found that the cause of such defect is clearly pointed out and explained in the course of the Treatise, or this Supplement.

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